Crashes of older Australian riders

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9 January 2006

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This research was supported by a grant from the Motor Accidents Authority of New South Wales. We would like to express our appreciation to the motorcycle safety researchers and representatives of rider groups who provided feedback on the draft questionnaire and helped publicise the survey. Thank you to all the riders who completed the survey. Ashley Verdoorn and Glenda Cairns programmed and implemented the Internet survey. Ian Morrison entered the data from paper questionnaires.

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ABSTRACT

Motorcyclist fatalities and injuries are increasing in many developed countries, particularly among older riders. Older riders are often grouped into continuing, returned and new riders. There is widespread concern about the safety of returned riders, but little objective data available. While Australian data show higher crash rates for young than for older riders and for newly licensed older riders than full licence holders (continuing and returned riders), the crash involvement of returned and continuing riders is difficult to compare because these groups cannot be separated in the official crash or licensing databases.

An Internet survey of motorcycle riders was undertaken in 2005 to compare the crash involvement of the three groups of older riders and identify implications for rider training and other rider safety measures. Paper questionnaires were provided to riders without Internet access. Respondents had ridden in Australia in the last five years and were aged 25 and over.

Of the 1,500 completed questionnaires, 930 were from continuing riders, 281 were from new riders, and 262 were from returned riders. The largest proportion of riders was aged 45-54. New riders were generally younger than returned riders. Most respondents rode in both rural and urban areas but about three-quarters rode less than 100 km in an average week. Continuing riders rode further in an average week than new and returned riders.

Riders were asked how many motorcycle accidents they had been involved in on Australian roads in the last five years in which someone was hurt, the Police were called, or a vehicle was damaged and had to be taken away. About 30% of riders had been involved in at least one crash.

Returned riders had a lower crash risk than continuing riders even after adjusting for the lower distance ridden in an average week by returned riders. While the crash risk of new and continuing riders did not differ significantly in this study, this may have reflected less riding during the previous five years by new riders.

Most crashes resulted in slight injuries (cuts and bruises). Injuries to new riders were less severe on average and there was a tendency for continuing riders to be less severely injured than returned riders. Riders aged 55-64 were over-represented in serious injury (admitted to hospital) crashes, possibly because they are more susceptible to injury than younger riders.

New riders had relatively more single vehicle (motorcycle only) crashes than continuing or returned riders. They were more likely to report that they were to blame for their crash, nominating not being able to handle the motorcycle well enough, not knowing what to do in the situation, being unfamiliar with the location, going too fast and not braking quickly enough as contributing factors on their part.

New riders were more likely to have completed a training course (93%) than continuing (67%) and returned riders (57%). Less than 10% of returned riders had completed a refresher course but almost 30% had completed an advanced course. Riders who had completed a training course were more likely to have been involved in a crash than those who had not. Riders who had completed a training course were more likely to have been involved in a crash. This counter-intuitive finding remained after adjusting for distance ridden.

INTRODUCTION

The number of older motorcyclists killed or injured in crashes has increased in the last decade in many developed countries including the United States (National Center for Statistics and Analysis Research and Development, 2005; Stutts, Foss & Svoboda, 2004), Great Britain (Sexton, Broughton, Elliot & Maycock, 2004) and Australia (Australian Transport Safety Bureau, 2005). In some countries, this increase has been the main contributor to an overall rise in motorcycle crashes.

The number of motorcyclist fatalities in the US has increased from a low of 2,116 in 1997 to 4,008 in 2004 (National Center for Statistics and Analysis Research and Development, 2005). The number of motorcyclists killed who were aged 40 years and over more than tripled from 1994 to 2004. The number of motorcyclists killed aged under 30 increased only slightly in the same period.

In the United Kingdom, there have been substantial reductions in the number of motorcyclist casualties aged under 20 and the number of casualties involving small motorcycles (less than 125cc) since the late 1980s/early 1990s (Lynam, Broughton, Minton & Tunbridge, 2001). In contrast, the number of casualties aged 30-39 has been growing since 1993. The riders of motorcycles with an engine capacity greater than 500cc (which require a full licence) dominate the casualty statistics with high proportions of fatalities occurring on non-built-up roads during the summer months (indicating recreational riding).

In Australia, the number of motorcyclist (rider and pillion) fatalities fell from a high of 299 in 1989 to 175 in 1997 and has varied between 188 in 2003 and 224 in 2002 since then. While there has been no clear increase in the total number of motorcyclists killed, Figure 1 shows that there has been a decrease in the number of motorcyclists aged under 25 killed and an increase in the number of riders aged 40 and over 25 since 1991. The percentage of riders killed aged over 25 increased from 49% in 1991 to 68% in 2004 (Australian Transport Safety Bureau, 2005).

This pattern is not confined to fatalities. In the State of Victoria, as in other jurisdictions, the involvement of "older" motorcyclists in crashes has increased since 1990. The number of riders in crashes aged 30 and over more than doubled from 501 in 1991 to 1,120 in 2003. In contrast, the number of riders in crashes aged under 30 more than halved from 1,353 in 1991 to 663 in 2003. Riders aged 30 and over comprised 26.8% of riders in crashes in 1991 and this increased to 63.2% in 2003.

The trends in motorcycle involvement in crashes have mirrored changes in motorcycle registration and rider licensing. While motorcycles comprise only about 3% of all motor vehicles registered in Australia, the number of motorcycles registered increased by 18.7% from 1999 to 2004 (Australian Bureau of Statistics, 2005). In contrast, numbers of passenger vehicles registered increased by only 9.7% over the same period. In the State of New South Wales, the number of motorcycles registered to people aged 40 and over increased by 57% between 1995 and 2000, while the number of motorcycles registered to people aged under 25 years decreased by 33% (de Rome and Stanford, 2002). Similarly, the median age of owners of registered motorcycles in the USA increased from 24 years in 1980 to 38 years in 1998 (Shankar, 2001).

While the numbers of older riders in crashes have increased, older riders have lower crash rates when measured in terms of licences held (Haworth et al., 2002) and in terms of distance travelled (Australian Transport Safety Bureau, 2002). Thus, there appear to be two main rider groups of concern; younger riders aged 16-24 years who continue to be over-represented in casualty crash rates, and older riders aged 30-54 who are the fastest growing group among serious crashes.

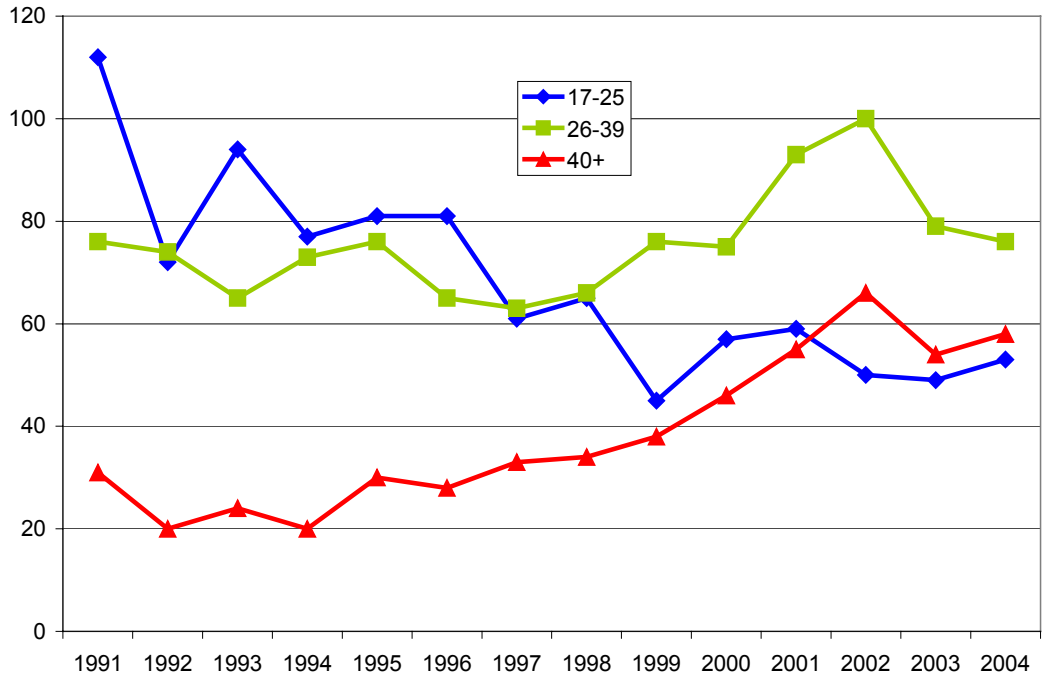

Figure 1. Number of motorcyclists (riders and pillion passengers) killed in on-road crashes in Australia. Source: Australian Transport Safety Bureau (2002, 2003, 2004, 2005).

Older riders can be categorised into three groups:

- Riders who have held licences and ridden for many years (continuing riders)
- Riders who have held licences for many years but have returned to riding only recently (returned riders)
- Riders who have only obtained a licence recently (new riders).

Considerable concern has been expressed about the safety of returned riders (e.g. Christie and Newland, 2001; Haworth et al., 2002). Haworth et al. (2002) conducted a survey of older riders aged 30 and over in Victoria and found that while less than 10 percent of riders reported being involved in a crash, returned riders exhibited a pattern of riding which might place them at a higher crash risk than continuing and new riders. Returned riders were less likely than new riders to have undertaken a training course and were more likely to ride for recreation than continuing riders. Returned riders were more likely to have never commuted, have stopped commuting, have started touring and have never ridden for general transport. Haworth, Smith, Brumen and Pronk (1997) demonstrated that the crash risk associated with recreational riding is at least double that of commuting or general transport.

As the numbers of crashed riders in Haworth et al's (2002) survey were too small to detect reliable differences in crash risk among continuing, returned and new riders, it was not possible to make conclusions about potential contributory factors in the crashes of these groups. As returned and continuing riders cannot be separated in the mass crash data or the licensing data, it was also not possible to determine differences in crash frequency or crash characteristics between continuing, returned and new riders using these sources.

The research aimed to support and extend the work of Haworth et al. (2002) by focusing in detail on the crash involvement patterns of a large sample of older riders in Australia. Older riders are defined differently in different states. As the target audience includes riders nation-wide and the most common definition of an older rider is a rider aged 25 or over, older riders were defined as those aged 25 and over.

METHOD

An on-line survey of motorcycle riders aged 25 and over was undertaken to explore potential contributors to crash risk such as attitudes, personal characteristics, self-reported riding behaviours and level of experience and training. The rationale for choosing this method and its advantages and disadvantages are discussed elsewhere (Mulvihill & Haworth, 2005).

As the primary focus of the survey was to identify the characteristics of crashes of older riders, it was originally proposed to survey crashed riders only. However, it became apparent that interpretation of some of the contributing factors to crashes would be difficult in the absence of responses from a non-crashed group. Therefore the design of the survey was modified to allow this control information to be collected.

The questionnaire was designed to tap those variables regarded as likely to influence crashes involving motorcycle riders and which could be measured using self-reported questionnaire scales. The questionnaire consisted of seven sections that addressed:

1. Rider licence and training experience
2. Riding patterns
3. Crashes in the last five years
4. Most recent crash – when and where
5. Most recent crash - who and why
6. Personal information
7. Rider attitudes and experience

Riders who had been involved in at least one crash in the last five years were asked to complete all sections. Riders who had not been involved in a crash did not complete sections 4 and 5 (and parts of section 3). A crash was defined as having occurred on the road in Australia, and where someone was hurt, or the Police were called, or a vehicle was damaged to the extent that it had to be taken away.

The questions in the first two sections were mostly taken from the Motorcycling After 30 – Rider Questionnaire developed by Haworth et al. (2002) to examine Victorian licence holders aged over 30 years. Most of the items in the next two sections were taken from the Motorcycle Accident Questionnaire and Site Inspection Form developed by Haworth, Smith, Brumen and Pronk (1997) for their Case Control Study of motorcycle crashes in Victoria and the UK Survey of Motorcyclists developed by Sexton, Baughan, Elliot and Maycock (2004).

Riders were informed about the survey through four main avenues:

- advertisements placed in popular motorcycling magazines,
- an article in a popular Victorian motoring club magazine,
- meetings, newsletters and websites of motorcycling clubs, and
- links and information about the survey on websites likely to be visited by riders.

In addition to providing the web address for the survey, the advertising materials also invited potential respondents to contact us to obtain a paper copy of the survey that could be returned by mail to minimise any biases resulting from lack of Internet access or computer illiteracy. A link was provided in the on-line questionnaire to a 'tips' page which respondents could access if they were experiencing difficulty accessing the survey due to problems of incompatible hardware or software systems.

Ethics approval for the study was granted by the Monash University Standing Committee on Ethics in Research on Humans on 14th February 2005. A draft questionnaire was posted on the Internet on 23rd February 2005 and piloted until 9th March 2005. The revised questionnaire was posted on the Internet on 9th March 2005. The closing date for the survey was mid-June 2005.

RESULTS

Survey responses

It is difficult to estimate a response rate for Internet-based surveys because the number of people who become aware of the survey but decide not to complete it is not known. Given the inability to calculate a traditional response rate for this study, an attempt was made to estimate the proportion of site visitors who completed the survey.

During piloting, 154 completed surveys were received. There were no counters in place during this period. Two counters were placed on the website for the final questionnaire. The first counter recorded that the introductory pages of the questionnaire (the Introduction and Explanatory Statement) were accessed 2,343 times. The second counter recorded 1,842 instances of someone accessing the questionnaire. Some of the discrepancy between the counters may have represented potential participants who were ineligible because they responded "No" to the filter questions relating to being 25 years or over and having ridden in Australia in the past five years.

Questionnaires were submitted by 1,290 respondents. The number of submitted questionnaires was thus 55% of Counter 1 and 70% of Counter 2. However, it is possible that individuals accessed the introductory pages of the questionnaire more than once before completing the questionnaire (e.g. read the introductory material and then decided to complete

the questionnaire at a later time). Therefore these percentages are likely to be underestimates of the percentage of riders who accessed the questionnaire who then went on to complete it.

Paper copies of the questionnaire were requested by 101 people and 71 (70%) completed questionnaires were mailed back. Another three people printed their own copies of the questionnaire and mailed them back. In total, 1,518 respondents completed the questionnaire (1,290 online, 74 paper, 154 pilot). Of these, 18 cases were excluded because they did not answer most or all of the questions.

General characteristics of respondents

Of the 1,500 valid questionnaires, 930 (62%) were submitted by continuing riders, 281 (19%) were from new riders, and 262 were from returned riders (17%). Overall, most (45%) of respondents were residents of Victoria, with 28% from New South Wales and 13% from Queensland. Most respondents stated that they rode in both rural and urban areas.

The characteristics of the three groups are summarised in Table 1. A one-way analysis of variance with post-hoc tests confirmed that the mean age of returned riders was higher than that of continuing riders which was higher than that of new riders. Chi-square tests were used to test the significance of differences in the proportions of riders from the three groups having particular characteristics and the significance values are presented in the table. There were relatively more new riders in the 25-34 age group (44%) and relatively more returned riders in the 45-54 year age group (47%). Females comprised a larger proportion of new riders (29%) than continuing or returned riders (8% and 9%). New riders were more likely than continuing or returned riders to have completed a rider training course. New riders had held a licence for 2.3 years on average, compared to 21.1 years for continuing riders and 26.5 years for returned riders.

The three groups of riders also differed in their riding patterns. Returned riders rode less distance per week and less often than continuing or new riders. The motorcycle was less likely to be their main means of transport and they were more likely to ride from October to March only (the warmer months).

Crash involvement

Riders were asked how many crashes they had been involved in while riding on Australian roads in the last five years. They were asked to include only those crashes in which someone was hurt, the Police were called, or a vehicle was damaged to the extent that it had to be taken away. Overall, 445 riders (about 30%) reported that they had been involved in at least one crash. About 75% of these riders had been involved in one crash, 20% in two crashes, 4% in three crashes and 2% in four crashes.

The characteristics of riders who reported being involved in one or more crashes are compared with those of non-crash-involved riders in Table 2. The results of univariate logistic regression analyses showed that increasing age was protective against crash involvement (OR=0.980) while being male (OR=1.852) and completing a training course (OR=1.58) were associated with increased crash risk. Compared to continuing riders, crash risk was significantly lower for returned riders (OR=0.578). Compared to riders who rode less than 50 kms in an average week, crash risk was significantly higher for riders who rode

101-200 kms per week (OR=1.549) and riders who rode 201 kms or more per week (OR=1.730).

Table 1. Characteristics of new, continuing and returned riders.

Characteristic	New	Continuing	Returned	
Mean age	39.3	45.6	49.3	F(2,1470)=45.4, p<.001
Age group				$\chi^2(8)=141.1$, p<.001
25-34	43.7%	21.7%	8.9%	
35-44	30.7%	27.0%	19.3%	
45-54	17.7%	34.3%	47.1%	
55-64	6.5%	13.6%	22.0%	
65+	1.4%	3.4%	2.7%	
Male	71.3%	92.2%	91.5%	$\chi^2(2)=91.7$, p<.001
Training course	93.2%	67.1%	56.9%	$\chi^2(2)=97.9$, p<.001
Years since licensed	2.3	21.1	26.5	F(2,1386)=287.7, p<.001
Distance ridden per week (kms)				$\chi^2(12)=31.0$, p<.005
Zero	9.7%	6.5%	12.4%	
Less than 50	19.4%	13.9%	18.9%	
51-100	24.5%	26.4%	26.3%	
101-200	20.5%	21.7%	19.3%	
201-300	12.6%	12.6%	9.7%	
301-400	13.3%	16.3%	13.1%	
400+	0.0%	2.5%	0.4%	
Frequency of riding				$\chi^2(10)=51.4$, p<.001
Not at all	1.4%	1.3%	1.5%	
1-5 days/year	2.5%	2.6%	3.8%	
1-3 days/month	8.0%	13.7%	24.1%	
1-2 days/week	31.5%	28.3%	35.6%	
3+ days/week	56.2%	53.4%	33.3%	
Other	0.4%	0.8%	1.5%	
Main means of transport				$\chi^2(4)=67.2$, p<.001
Mostly motorcycle	38.0%	38.9%	18.4%	
Mostly car/other	33.3%	35.4%	61.3%	
Mixture motorcycle and car/other	28.7%	25.7%	20.3%	
Ride October to March only	9.7%	8.7%	14.2%	$\chi^2(2)=6.5$, p<.05

Table 2. Comparisons of characteristics of crash and non-crash involved riders. Odds ratios and confidence intervals from univariate logistic regression analyses.

Characteristic	Crash-involved	Non-crash involved	OR	95% CI	p value
Mean age	41.0	44.7	0.980	0.97-0.99	.000
Male	91.6%	85.4%	1.852	1.26-2.71	.002
Group					
New	18.6%	20.2%	0.807	0.61-1.08	.154
Continuing	68.0%	59.5%			
Returned	13.4%	20.3%	0.578	0.42-0.80	.001
Distance ridden per week (km)					
Less than 50	20.1%	27.1%			
51-100	24.5%	27.7%	1.195	0.86-1.67	.294
101-200	22.7%	19.7%	1.549	1.10-2.19	.013
201 or more	32.6%	25.4%	1.730	1.25-2.39	.001
Training course	77.5%	68.5%	1.580	1.22-2.06	.001

The results of the multivariate logistic regression largely confirmed those of the univariate analyses (see Table 3) with the exception that crash risk was not significantly elevated compared with riding less than 50 km per week until 201 kms per week or more (OR=1.622).

Table 3. Adjusted odds ratios and confidence intervals from multivariate logistic regression analyses.

Characteristic	OR (adjusted)	95% CI	p value
Mean age	0.978	0.97-0.99	.002
Male	1.910	1.27-2.87	.002
Group			
New	0.733	0.53-1.01	.060
Continuing			
Returned	0.657	0.47-0.93	.017
Distance ridden per week (km)			
Less than 50			
51-100	1.132	0.80-1.60	.480
101-200	1.417	0.99-2.03	.057
201 or more	1.622	1.17-2.26	.004
Training course	1.545	1.17-2.05	.001

For those riders who were crash involved, crash severity for the most recent crash was measured in terms of injuries sustained to the rider and the damage to the rider's motorcycle. Riders most commonly suffered slight injuries (cuts and bruises) (46% of crashes) rather than no injuries or serious injuries. The percentages of riders in crashes who were not injured were similar across the groups (18-21%). Compared to continuing and returned riders, new riders in crashes were more likely to be slightly injured and less likely to be treated in a hospital emergency department or admitted to hospital.

Riders aged 55-64 were over-represented in serious injury (admitted to hospital) crashes. This may be because older riders are more susceptible to injury in a crash than younger riders.

Sports style motorcycles were the most common style of motorcycle ridden at the time of the crash (30%), followed by sports/touring motorcycles (21%). There was no significant difference in the styles of motorcycles in crashes for continuing, returned and new riders ($\chi^2(12)= 16.9$, $p>.05$.) although continuing riders appeared somewhat less likely to be riding cruiser style motorcycles.

Crash types

Over half of the crashes were single vehicle (53%) (involving the motorcycle only). New riders appeared to be over-represented in single vehicle crashes (61%) compared to returned riders (55%) and continuing riders (51%).

About 53% of crashes occurred in low speed riding environments (60 km/h or less speed zones). About 23% occurred in medium speed riding environments (70-90 km/h speed zones) and 24% occurred in high speed riding environments (100-110 km/h zones). A greater proportion of crashes were single-vehicle in high speed riding environments (74%) than in medium (56%) and low speed (42%) riding environments ($\chi^2(2)= 29.6$, $p<.001$).

Overall, 153 respondents stated that their most recent crash had occurred at an intersection (28% of those who answered this item). The most common type of intersection was a T-intersection. Similar percentages of continuing, returned and new riders stated that their crash occurred at an intersection.

Contributing factors to crashes

The level of experience with that motorcycle prior to the crash differed significantly among the three groups of riders ($\chi^2(6)= 56.7$, $p<.001$.). New riders were most likely to have ridden the motorcycle less than 1,000 kms (13.6%), followed by returned riders (8.5%) then continuing riders (4.4%).

Riders were asked whether any of a list of road surface factors contributed to their crash (multiple responses were allowed). Slippery surface (18% of riders in crashes) and loose gravel (18% of riders in crashes) were the road factors most commonly nominated by all three groups of riders. New riders were somewhat more likely to nominate loose gravel and less likely to nominate slippery surface.

Overall, 46% of riders said they were "not at all to blame" for the crash, 18% said "a little", 17% said "entirely", 12% said "a lot" and 7% said "about half". A larger proportion of

continuing riders reported that they were not at all to blame for the crash (52%) compared to returned (42%) and new riders (32%). A larger proportion of new riders reported that they were 'quite a lot' and 'entirely' to blame for their crash (20% quite a lot, 28% entirely) than returned (12% quite a lot, 22% entirely) and continuing riders (9% quite a lot, 12% entirely).

About half of the riders reported that there was nothing they could have done to avoid the crash. Another 15% reported that they could have avoided the crash if they had better observation skills and abilities and about 13% said they could have slowed down earlier.

Riders were asked to nominate the main contributors on their own part to the crash (multiple responses were allowed). In 32% of crashes, riders considered that there was no contribution on their part to the crash. In 35% of crashes, riders considered that they had not noticed something until it was too late. New riders were more likely to nominate at least one contributor on their part to the crash. New riders more commonly than other riders nominated not being able to handle the motorcycle well enough (27%), not knowing what to do in the situation (21%), being unfamiliar with the location (20%), going too fast (17%) and not braking quick enough (12%).

The main contributors on the part of the other driver in multi-vehicle crashes (multiple responses were allowed) were considered by riders to be: not noticing something until it was too late (40% of crashes), doing something unpredictable (32%), not giving way (31%) and being distracted or not concentrating (29%). Returned riders were more likely than other riders to consider that the other driver was going too fast (31%) or did not know what to do in the situation (31%). New riders were more likely than other riders to consider that the other driver did not notice something until too late (66%) or the driver was distracted or not concentrating (44%).

Rider training

Overall, 79% of respondents reported that they had undertaken a motorcycle rider training course. New riders were significantly more likely to report that they had completed a training course (93%) than continuing (67%) and returned riders (57%). Continuing and returned riders were much more likely to have undertaken advanced rider training than new riders. New riders comprised a larger proportion of riders who had completed a Learner (22%) or a Licence course (48%) compared to continuing (5% Learner, 20% Licence) and returned riders (7% Learner, 13% Licence). Less than 10% of returned riders had completed a refresher course while almost 30% had completed an advanced course. Surprisingly, more continuing riders had completed a refresher course.

Riders who had completed a training course were more likely to have been involved in a crash. This counter-intuitive finding does not appear to be an artifact of trained riders riding further or more often, because adjusting for these factors in the multivariate logistic regression made almost no difference to the odds ratio associated with training (univariate OR=1.58, multivariate OR=1.580). Rather, it appears to reflect the greater propensity for new riders to have undertaken training and their likely higher crash risk.

DISCUSSION

The results of this survey reinforce those of earlier studies (e.g. Haworth et al., 2002) that the distance ridden by many older riders is quite low. About half of the riders who responded rode less than 100 kms in an average week. Thus, motorcycling is a discretionary activity for these riders, rather than being their sole or favoured means of transport.

Given the concern about the safety of returned riders discussed in the Introduction, it is somewhat surprising that returned riders had a lower crash risk than continuing riders. This finding remained even after adjusting for the lower distance ridden in an average week by returned riders. Perhaps the returned riders in the study were avoiding riding in more hazardous conditions given that they are less likely to be using the motorcycle as their main means of transport – or perhaps they are riding more conservatively. These possible explanations will be explored in further analyses of the survey data.

While new riders did not differ from continuing riders in their crash risk in this study, the comparisons may have been somewhat misleading. The question about crash involvement related to riding in the last five years, but new riders had only held a licence for 2.3 years on average, with continuing and returned riders having held a licence for more than 20 years on average. Thus while almost all continuing and returned riders had ridden during the entire past five years, about half of the new riders had not ridden for at least half of this period and so had less exposure to risk of crashing. If the question about crash involvement had covered a shorter period, it is likely that the proportion of new riders would have been elevated relative to the proportions of continuing and returned riders.

Older and returned riders appeared to be more seriously injured in crashes. It is unclear from the data whether this outcome reflects differences in crash severity or greater susceptibility to injury in older adults.

New riders had relatively more single vehicle (motorcycle only) crashes than continuing or returned riders. The contributing factors appear to be inexperience on that particular motorcycle and difficulties with loose gravel and slippery surfaces. New riders were more likely than other riders to report that they were to blame for their crash, nominating not being able to handle the motorcycle well enough, not knowing what to do in the situation, being unfamiliar with the location, going too fast and not braking quickly enough as contributing factors on their part.

These findings have important implications for rider training. The limited amount of riding by many riders means that skills that are trained may not receive sufficient practice. The paradox is that encouraging practice will increase exposure and, therefore, the absolute number of crashes.

Many returned riders have not taken refresher courses. New riders were more likely to have taken training courses than continuing or returned riders. Nevertheless, new riders reported a number of factors contributing to their crashes that relate to lack of development of both vehicle and cognitive skills specific to riding. These results suggest the need for increased skill development in a safe environment. More substantial off-road training for novice riders may have the potential to remedy some of these issues. Current training courses for novice riders are typically very short (one or two days) and do not provide sufficient skills for safe, unsupervised operation on real roads (Haworth, Smith & Kowadlo, 2000).

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